510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number:

k131488

B. Purpose for Submission:

New reagents (Albumin, Total Protein, Calcium-Arsenazo and Inorganic Phosphorus U.V. Reagent added onto ACE Alera instrument

Addition of lithium heparin plasma samples to already cleared reagents on the ACE (k930104) and ACE Axcel (k113389) instruments.

C. Measurand:

Albumin, Total Protein, Calcium, Phosphorus

D. Type of Test:

Quantitative, photometric/colorimetric methods

E. Applicant:

Alfa Wasserman Diagnostic Technologies, LLC

F. Proprietary and Established Names:

ACE Albumin Reagent

ACE Total Protein Reagent

ACE Calcium-Arsenazo Reagent

ACE Inorganic Phosphorus U.V. reagent

G. Regulatory Information:

Product Code	Classification	Regulation Section	Panel
CIX	Class II	21 CFR § 862.1035 Albumin Test System	Clinical Chemistry (75)
CEK	Class II	21 CFR § 862.1635 Total Protein Test System, meets limitations of	Clinical Chemistry (75)

		exemptions per 21 CFR § 862.9 (c) (9)	
CJY	Class II	21 CFR § 862.1145 Calcium Test System	Clinical Chemistry (75)
CEO	Class I, reserved	21 CFR § 862.1580 Phosphorus (inorganic) test system	Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See indications for use below

2. Indication(s) for use:

   The ACE Albumin Reagent is intended for the quantitative determination of albumin concentration in serum and lithium heparin plasma using the ACE, ACE Alere and ACE Axcel Chemistry Systems. Albumin measurements are used in the diagnosis and treatment of numerous diseased involving primarily the liver or kidneys. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

   The ACE Total Protein Reagent is intended for the quantitative determination of total protein concentration in serum and lithium heparin plasma using the ACE, ACE Alera and ACE Axcel Clinical Chemistry System. Total protein measurements are used in the diagnosis and treatment of a variety of diseases involving the liver, kidney, or bone marrow as well as other metabolic or nutritional disorders. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

   The ACE Calcium-Arsenazo Reagent is intended for the quantitative determination of calcium concentration in serum and lithium heparin plasma using the ACE, ACE Alera and ACE Axcel Clinical Chemistry Systems Calcium measurements are used in the diagnosis and treatment of parathyroid disease, a variety of bone diseases, chronic renal disease and tetany (intermittent muscular contractions or spasms). This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

   The ACE Inorganic Phosphorus U.V. Reagent is intended for the quantitative determination of inorganic phosphorus concentration in serum and lithium heparin plasma using the ACE, ACE Alera and ACE Axcel Clinical Chemistry Systems Measurements of inorganic phosphorus are used in the diagnosis and treatment of various disorders, including parathyroid gland and kidney diseases and vitamin D imbalance. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

3. Special conditions for use statement(s):

   For *in vitro* diagnostic use only

   For prescription use and Point-of-Care settings

4. Special instrument requirements:

For use on the ACE, ACE Axcel and ACE Alera Clinical Chemistry Systems.

I. Device Description:

The ACE Albumin Reagent consists of a single reagent bottle containing Bromcresol green (0.39 mmol/L) Acetate buffer, Preservative and Surfactant.

The ACE Total Protein Reagent consists of a single reagent bottle which contains Copper sulfate (12 mmol/L), Sodium potassium tartrate (32 mmol/L), Potassium iodide (30 mmol/L), Sodium hydroxide (600 mmol/L) and non-reactive ingredients.

The ACE Calcium-Arsenazo Reagent consists of a single reagent bottle containing Arsenazo III (≥0.15 mmol/L) Buffer and Surfactant.

The ACE Inorganic Phosphorus U.V. Reagent consists of a single reagent bottle containing Ammonium molybdate (0.48 mmol/L), Sulfuric Acid (220 mmol/L), and Surfactant

J. Substantial Equivalence Information:

1. Predicate device name(s):

ACE Albumin Reagent

ACE Total Protein Reagent

ACE Calcium-Arsenazo Reagent

ACE Inorganic Phosphorus U.V. Reagent

2. Predicate 510(k) number(s):

k930104

3. Comparison with predicate:

ACE Albumin reagent:

Similarities and Differences		
Item	Candidate Device	Predicate Device
Intended Use	Same	The ACE Albumin Reagent is intended for the quantitative determination of albumin concentration
Measurand	Same	Albumin
Assay Method	Same	Photometric
Measuring Range	0.3-7.0 g/dL	0.1-7.6 g/dL
Matrix	Human serum and Li	Human Serum

Similarities and Differences		
Item	Candidate Device	Predicate Device
	heparin plasma	
Instrument platform	ACE, ACE Alera, and ACE Axcel clinical chemistry system	ACE clinical chemistry system

ACE Total Protein Reagent:

Similarities and Differences		
Item	Candidate Device	Predicate Device
Intended Use	Same	The ACE Total Protein reagent is for the quantitative determination of Total Protein concentration.
Measurand	Same	Total Protein
Assay Method	Same	Colorimetric
Measuring Range	0.4-14.0 g/dL	0.2-15.1 g/dL
Matrix	Human serum and Li heparin plasma	Human serum
Instrument platform	ACE, ACE Alera, and ACR Axcel clinical chemistry system	ACE clinical chemistry system

ACE Calcium Reagent:

Similarities and Differences		
Item	Candidate Device	Predicate Device
Intended Use	Same	The ACE Calcium-Arsenazo Reagent is for the quantitative determination of Calcium concentration.
Measurand	Same	Calcium
Assay Method	Same	Photometric
Measuring Range	0.4-15.0 mg/dL	0.2-16.5 mg/dL
Matrix	Human urine, serum and Li heparin plasma	Human serum
Instrument platform	ACE, ACE Alera, and ACR Axcel clinical chemistry system	ACE clinical chemistry system

ACE Inorganic Phosphorus U.V. Reagent:

Similarities and Differences		
Item	Candidate Device	Predicate Device
Intended Use	Same	The ACE Inorganic Phosphorus U.V. reagent is for the quantitative determination of Phosphorus concentration.
Measurand	Same	Phosphorus

Similarities and Differences		
Item	Candidate Device	Predicate Device
Assay Method	Same	Colorimetric
Measuring Range	0.4-20.0 mg/dL	0.2-21 mg/dL
Matrix	Human urine, serum and Li heparin plasma	Human serum
Instrument platform	ACE, ACE Alera, and ACR Axcel clinical chemistry system	ACE clinical chemistry system

K. Standard/Guidance Document Referenced (if applicable):

Evaluation of Precision Performance of Quantitative Measurement Methods; (CLSI EP05-A2)

Method Comparison and Bias Estimation using Patient Samples; (CLSI EP09-A2-IR)

Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; (CLSI EP-17-A2)

Evaluation of the linearity of Quantitative Measurement Procedures: A statistical approach: (CLSI EP6-A)

Interference Testing in Clinical Chemistry; (CLSI EP07-A2)

L. Test Principle:

The ACE Albumin Reagent is a photometric assay in which Bromcresol green (BCG) binds specifically to albumin to form a green colored complex, which is measured bichromatically at 629 nm/692 nm. The intensity of color produced is directly proportional to the albumin concentration in the sample.

The ACE Total Protein Reagent is a colorimetric assay in which Cupric ions react with the peptide bonds of proteins under alkaline conditions to form a violet colored complex, which is measured bichromatically at 544 nm/692 nm. The intensity of color produced is directly proportional to the total protein concentration in the sample.

The ACE Calcium-Arsenazo Reagent utilizes a dye binding procedure in which calcium forms a blue-purple complex with Arsenazo III under acidic conditions

Calcium reacts with Arsenazo III in an acidic solution to form a blue-purple colored complex, which is measured bichromatically at 647 nm/692 nm. The intensity of color produced is directly proportional to the calcium concentration in the sample.

The ACE Inorganic Phosphorus U.V. Reagent is a colorimetric assay in which under acidic conditions, inorganic phosphorus in serum reacts with ammonium molybdate to form an unreduced phosphomolybdate complex, which absorbs strongly at 340 nm. The increase in absorbance, measured bichromatically at 340 nm/378 nm, is directly proportional to the amount of phosphorus in the sample.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

The precision of the ACE Albumin, Total Protein, Calcium and Phosphorus assays was evaluated in-house using an ACE Alera analyzer. Human serum samples at 3 concentrations of the respective measurand were evaluated using a 20 day precision study. The study was performed measuring each sample 2 times per run, 2 runs per day for 20 days for a total of 80 measurements per sample using 1 reagent lot. The results are provided in the table below.

Measurand	Sample Mean (mg/dL)	Within Run		Total	
		SD	%CV	SD	%CV
Albumin g/dL	2.6	0.03	1.3	0.05	2.0
	3.4	0.07	1.9	0.09	2.5
	4.3	0.03	0.7	0.10	2.3
Calcium mg/dL	6.5	0.08	1.3	0.13	2.1
	9.8	0.12	1.2	0.22	2.3
	12.6	0.23	1.8	0.29	2.3
Total Protein g/dL	4.2	0.10	2.3	0.11	2.6
	6.8	0.09	1.3	0.14	2.1
	10.1	0.23	2.3	0.32	3.1
Inorganic Phosphorus mg/dL	2.0	0.04	2.3	0.11	5.7
	3.8	0.12	3.2	0.16	4.2
	6.5	0.17	2.5	0.24	3.6

Plasma and Serum in house precision study:

The precision of the ACE Albumin, Calcium, Total Protein and Phosphorus assays for matched serum and Lithium heparin plasma samples at 3 concentrations of the respective measurand was evaluated in house over a period of 4 to 6 days. In this

study, matched serum and plasma with a low concentration of measurand from a single donor was spiked to a high concentration of measurand with commercially-available analyte and then the remaining sample prepared by intermixing. ACE Albumin was measured 2 times per run for 2 runs per day for 5 days (n=20). ACE Calcium was measured 2 times per run for 2 runs per day for 5 days (n=20). ACE Total Protein was measured 2 times per run for 2 runs per day for 6 days (n=24). ACE Inorganic Phosphorus was measured 2 times per run for 2 runs per day for 4 days (n=16)

All samples were tested on the ACE, ACE Alera and ACE Axcel analyzers.

Albumin

ACE analyzer		Within run		Total	
Sample Mean (g/dL)	Sample Type	SD	%CV	SD	%CV
4.1	Serum	0.05	1.3	0.07	1.6
3.8	Plasma	0.06	1.7	0.06	1.7
5.4	Serum	0.08	1.6	0.10	1.8
5.0	Plasma	0.05	1.0	0.07	1.4
6.5	Serum	0.07	1.1	0.11	1.6
6.2	Plasma	0.09	1.5	0.10	1.7

ACE Alera Analyzer		Within run		Total	
Sample Mean (g/dL)	Sample Type	SD	%CV	SD	%CV
4.1	Serum	0.04	0.9	0.04	1.1
3.7	Plasma	0.03	0.8	0.05	1.4
5.3	Serum	0.05	1.0	0.06	1.1
5.0	Plasma	0.08	1.7	0.08	1.7
6.5	Serum	0.05	1.3	0.08	1.3
6.1	Plasma	0.08	1.3	0.10	1.6

ACE Axcel Clinical Chemistry analyzer		Within run		Total	
Sample Mean (g/dL)	Sample Type	SD	%CV	SD	%CV
4.1	Serum	0.02	0.5	0.04	1.0
3.7	Plasma	0.06	1.6	0.06	1.6
5.3	Serum	0.03	0.6	0.03	0.6

4.9	Plasma	0.04	0.9	0.05	1.1
6.4	Serum	0.06	1.0	0.09	1.3
6.1	Plasma	0.05	0.9	0.08	1.3

Total Protein

ACE analyzer		Within run		Total	
Sample Mean (g/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
6.7	Serum	0.06	1.0	0.07	1.0
7.2	Plasma	0.06	0.9	0.06	0.9
8.4	Serum	0.11	1.3	0.11	1.3
8.8	Plasma	0.04	0.5	0.06	0.7
10.1	Serum	0.07	0.7	0.08	0.8
10.3	Plasma	0.13	1.3	0.14	1.4

ACE Alera analyzer		Within run		Total	
Sample Mean (g/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
6.7	Serum	0.05	0.7	0.05	0.8
7.1	Plasma	0.08	1.1	0.09	1.2
8.4	Serum	0.08	1.0	0.08	1.0
8.7	Plasma	0.06	0.7	0.10	1.2
10.0	Serum	0.07	0.7	0.09	0.9
10.2	Plasma	0.11	1.1	0.14	1.3

ACE Axcel analyzer		Within run		Total	
Sample Mean (g/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
6.8	Serum	0.08	1.1	0.09	1.3
7.2	Plasma	0.05	0.7	0.08	0.9
8.4	Serum	0.07	0.8	0.11	1.4
8.8	Plasma	0.07	0.8	0.11	1.4
10.1	Serum	0.07	0.7	0.09	0.9
10.4	Plasma	0.08	0.8	0.10	1.0

Calcium

ACE analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
9.3	Serum	0.12	1.3	0.25	2.7
8.4	Plasma	0.04	0.5	0.20	2.4
11.7	Serum	0.18	1.6	0.20	1.7
10.7	Plasma	0.19	1.7	0.20	1.9
13.9	Serum	0.20	1.4	0.20	1.4
13.0	Plasma	0.25	1.9	0.26	2.0

ACE Alera analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
9.3	Serum	0.09	0.9	0.22	2.4
8.3	Plasma	0.10	1.2	0.17	2.0
11.6	Serum	0.14	1.2	0.14	1.2
10.7	Plasma	0.13	1.2	0.15	1.4
13.8	Serum	0.19	0.14	0.19	1.4
12.9	Plasma	0.13	1.0	0.14	1.1

ACE Axcel analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
9.3	Serum	0.08	0.8	0.17	1.8
8.3	Plasma	0.08	0.9	0.11	1.4
11.6	Serum	0.10	0.9	0.11	0.9
10.7	Plasma	0.12	1.2	0.13	1.2
13.8	Serum	0.09	0.7	0.11	1.2
13.1	Plasma	0.15	1.2	0.18	1.4

Phosphorus

ACE analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
3.5	Serum	0.15	4.4	0.17	5.0
3.1	Plasma	0.16	5.1	0.18	5.9
10.2	Serum	0.04	0.3	0.05	0.5
9.8	Plasma	0.09	0.9	0.09	0.9
17.0	Serum	0.26	1.5	0.26	1.6
16.7	Plasma	0.23	1.4	0.24	1.4

ACE Alera analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
3.4	Serum	0.11	3.1	0.14	4.0
3.0	Plasma	0.11	3.7	0.15	5.0
9.9	Serum	0.08	0.8	0.08	0.8
9.6	Plasma	0.07	0.8	0.08	0.8
16.6	Serum	0.22	1.3	0.22	1.3
16.3	Plasma	0.24	1.5	0.29	1.8

ACE Axcel analyzer		Within run		Total	
Sample Mean (mg/dL)	**Sample Type**	**SD**	**%CV**	**SD**	**%CV**
3.5	Serum	0.11	3.1	0.14	4.1
3.1	Plasma	0.15	5.0	0.19	6.1
10.2	Serum	0.04	0.4	0.12	1.2
9.9	Plasma	0.06	0.6	0.12	1.2
17.3	Serum	0.28	1.6	0.30	1.7
16.9	Plasma	0.30	1.8	0.32	1.9

Serum POL Precision study:

The precision of the ACE Albumin, Calcium, Total Protein and Phosphorus assays at in-house and 3 physician office laboratories (POLs) for matched serum samples at 3 concentrations of the respective measurand was evaluated using a multiple day precision study. In this precision study, serum with a low concentration of measurand from a single

donor was spiked to a high concentration of measurand with commercially-available analyte and then the remaining sample prepared by intermixing. The study was performed measuring each sample 2 times per run, 2 runs per day for 5-6 days using 1 reagent lot for a total of 20 measurements per sample on the ACE Alera analyzer. The results of the precision study are presented in the table below.

Albumin

			Experimental Result	
			SD (g/dL) or %CV	
Lab	Sample	Mean	Within-Run	Total
In-House	1	3.5	0.02	0.04
			0.6%	1.1%
POL 1	1	3.5	0.05	0.06
			1.4%	1.7%
POL 2	1	3.6	0.05	0.05
			1.4%	1.5%
POL 3	1	3.5	0.05	0.05
			1.6%	1.6%
In-House	2	5.0	0.05	0.05
			1.0%	1.1%
POL 1	2	5.0	0.08	0.09
			1.7%	1.9%
POL 2	2	5.0	0.06	0.08
			1.2%	1.6%
POL 3	2	4.9	0.03	0.03
			0.6%	0.7%
In-House	3	6.2	0.06	0.07
			1.0%	1.1%
POL 1	3	6.2	0.07	0.10
			1.1%	1.6%
POL 2	3	6.2	0.06	0.07
			1.0%	1.1%
POL 3	3	6.1	0.08	0.08
			1.3%	1.4%

Total Protein

			Experimental Result	
			SD (g/dL) or %CV	
Lab	Sample	Mean	Within-Run	Total
In-House	1	5.3	0.08	0.10
			1.5%	1.8%
POL 1	1	5.5	0.07	0.10
			1.4%	1.8%
POL 2	1	5.2	0.07	0.15
			1.3%	2.8%
POL 3	1	5.3	0.07	0.12
			1.4%	2.2%
In-House	2	8.3	0.10	0.11
			1.2%	1.4%
POL 1	2	8.4	0.09	0.10
			1.1%	1.2%
POL 2	2	8.4	0.10	0.11
			1.2%	1.4%
POL 3	2	8.2	0.09	0.14
			1.1%	1.7%
In-House	3	11.3	0.14	0.15
			1.3%	1.4%
POL 1	3	11.3	0.14	0.14
			1.2%	1.2%
POL 2	3	11.5	0.09	0.16
			0.8%	1.4%
POL 3	3	11.1	0.26	0.31
			2.3%	2.8%

Calcium

			Experimental Result	
			SD (mg/dL) or %CV	
Lab	Sample	Mean	Within-Run	Total
In-House	1	6.9	0.08	0.15
			1.2%	2.1%
POL 1	1	6.9	0.07	0.19
			1.0%	2.7%
POL 2	1	7.0	0.19	0.19
			2.7%	2.7%
POL 3	1	7.0	0.14	0.14
			1.9%	1.9%
In-House	2	10.5	0.05	0.06
			0.5%	0.6%
POL 1	2	10.5	0.09	0.33
			0.9%	3.2%
POL 2	2	10.6	0.21	0.22
			1.9%	2.1%
POL 3	2	10.6	0.16	0.16
			1.5%	1.5%
In-House	3	13.5	0.17	0.20
			1.3%	1.5%
POL 1	3	13.4	0.14	0.34
			1.1%	2.5%
POL 2	3	13.6	0.21	0.23
			1.5%	1.7%
POL 3	3	13.6	0.14	0.18
			1.0%	1.3%

Phosphorus

			Experimental Result	
			SD (mg/dL) or %CV	
Lab	Sample	Mean	Within-	Total
In-House	1	2.8	0.06	0.06
			2.1%	2.1%
POL 1	1	2.7	0.04	0.10
			1.4%	3.8%
POL 2	1	2.5	0.02	0.11
			0.9%	4.4%
POL 3	1	2.9	0.05	0.07
			1.9%	2.4%
In-House	2	7.1	0.07	0.09
			0.9%	1.3%
POL 1	2	7.1	0.07	0.18
			0.9%	2.5%
POL 2	2	6.7	0.07	0.22
			1.1%	3.2%
POL 3	2	7.4	0.10	0.13
			1.4%	1.7%
In-House	3	11.3	0.09	0.11
			0.8%	0.9%
POL 1	3	11.3	0.16	0.27
			1.4%	2.4%
POL 2	3	10.6	0.15	0.21
			1.4%	1.9%
POL 3	3	11.7	0.11	0.14
			0.9%	1.2%

b. Linearity/assay reportable range:

The linearity of the ACE Alera analyzer was assessed in one run using one lot of reagents with each sample tested in triplicate. Six diluted serum samples with

measuring concentrations evenly distributed were prepared by diluting a high measured concentration serum pool. This yielded linearity samples with levels that spanned the measuring range of each of the four analytes (Albumin, Total Protein, Calcium and Phosphorus) measured.

The sponsor calculated linear and polynomial regressions from mean observed values versus expected values using an unweighted regression model. The linear regressions between the expected values and the measured values are found in the table below:

Measurand	**Range tested**	**Slope**	**Intercept**	**r^2**
Albumin (g/dL)	0.1-7.6	0.980	0.01	0.9982
Total Protein (g/dL)	0.2-15.1	0.991	0.04	0.9979
Calcium (mg/dL)	0.3-16.5	0.992	0.27	0.990
Phosphorus (mg/dL)	0.2-21 mg/dL	1.001	0.03	0.9995

The linearity supports the sponsor's claimed reportable range of the Albumin assay is 0.3-7.0 g/dL, Total Protein assay is 0.4-14.0 g/dL, Calcium assay is 0.4-15.0 mg/dL and Phosphorus 0.4-20.0 mg/dL

Auto-dilution study:

Sponsor performed an auto-dilution study to confirm the auto-dilution function (1:3) on the ACE Alera analyzer for each measurand for plasma and serum samples by comparing the auto-diluted results to the manual dilution results. Sample recovery was within +/- 10% bias for all samples tested.

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

Analyte	Traceability
Albumin	NIST SRM 927
Total Protein	NIST SRM 927
Calcium	NIST SRM 909, NIST SRM 915b
Phosphorus	NIST SRM 200, NIST SRM 3139a

The Albumin, Total Protein, Calcium and Phosphorus calibrators have been previously cleared in k930104.

d. *Detection limit:*

LoB, LoD and LoQ studies for each measurand were evaluated based upon CLSI EP-17A using the ACE Alera analyzer.

LoB Test Protocol

Blank samples (n=5) were measured in replicates of 4 for 3 days for a total of n=60 measurements.

LoD Protocol

Low serum-based samples (n=5) and blank samples (n=5) were measured in replicates of 4 per day for 3 days for a total of n=60 measurements

LoQ Protocol

LoQ was determined by evaluating 5 low level samples with multiple replicates over multiple days for a total of 40 measurements per sample. LoQ values are based on inter-assay precision of <20% CV.

	Albumin (g/dL)	**Total Protein (g/dL)**	**Calcium (mg/dL)**	**Inorganic Phophorus (mg/dL)**
LoB	0.08	0.08	0.09	0.25
LoD	0.09	0.13	0.11	0.35
LoQ	0.09	0.20	0.23	0.35

The sponsor claimed the following measuring ranges:

Measurand	Assay Range
Albumin (g/dL)	0.3-7.0
Total Protein (g/dL)	0.4-14.0
Calcium (mg/dL)	0.4-15.0
Phosphorus (mg/dL)	0.4-20.0

e. Analytical specificity:

Interference testing was performed according to CLSI-EP07 to determine whether the presence of hemoglobin, triglycerides (Intralipid), icterus (bilirubin), and ascorbic acid may interfere with results for each measurand using the ACE Alera analyzer.

Human serum samples were used with two different concentrations (normal and abnormal) of measurand (Albumin, Total Protein, Calcium and Phophorus). Each sample level was spiked with increasing amounts of interferent for a total of 7 samples with interferent. Control samples at each level which were not spiked were

used to compare with spiked samples. The spiked and unspiked samples were tested and used to calculate % recovery (measured concentration compared to measured concentration with zero interferent). Measurand recovery of <10% of control value was defined as non-significant interference. The results of the highest concentration tested without significant interference are summarized in the table below.

Measurand	Icterus (mg/dL)	Hemolysis (mg/dL)	Lipemia (mg/dL)	Ascorbic Acid (mg/dL)
Albumin	57	250	929	6
Total Protein	56.8	250	929	6
Calcium	58.8	1000	1000	6
Phosphorus	11.5	250	306	6

The following limitations are included in the labeling for Albumin and Total Protein "Do not use hemolyzed samples".

The following limitations are included in the labeling for Phosphorus "Use clear, unhemolyzed serum or lithium heparin plasma.

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. Method comparison with predicate device:

Serum Method Comparison:

Method comparison studies were conducted at 3 POC sites and in house following CLSI EP9-A2. Samples were analyzed on the ACE Clinical Chemistry System at Alfa Wassermann and the results were compared against those gathered on the ACE Alera Clinical Chemistry Systems at 3 Physician Office Labs (POL). At least 50 determinations were made in singlicate for serum samples drawn from the same individuals on the same platform. To test across the reportable range of the assay, additional sets (<7 sets) of altered samples (spikes or diluted) were used to cover the full measuring range of each analyte. Results are summarized in the table below.

Albumin	ACE (in-house) vs. ACE Alera (POL)		
	POL 1	POL 2	POL 3
N	50	50	50
Range (g/dL)	1.0-6.4	1.0-6.4	1.0-6.4
Regression Equation	y=1.004x-0.03	y=1.005x-0.05	y=0.982x+0.01
R^2	0.9949	0.9960	0.9967

Total Protein	ACE (in-house) vs. ACE Alera (POL)		
	POL 1	POL 2	POL 3
N	51	51	51
Range (g/dL)	0.9-13.6	0.9-13.6	0.9-13.6
Regression Equation	y=0.99x+0.16	y=1.027x-0.06	y=0.979x+0.24
R^2	0.9969	0.9962	0.9964

Calcium	ACE (in-house) vs. ACE Alera (POL)		
	POL 1	POL 2	POL 3
N	50	50	50
Range (mg/dL)	1.9-13.7	1.9-13.7	1.9-13.7
Regression Equation	y=0.992x-0.09	y=1.007x-0.11	y=1.008x-0.08
R^2	0.9904	0.9929	0.9929

Phosphorus	ACE (in-house) vs. ACE Alera (POL)		
	POL 1	POL 2	POL 3
N	50	50	50
Range (mg/dL)	1.0-18.4	1.0-18.4	1.0-18.4
Regression Equation	y=1.015x+0.14	y=0.960x+0.12	y=0.984x+0.05
R^2	0.9992	0.9986	0.9991

b. Matrix comparison

A matrix comparison was performed using paired serum/lithium heparin plasma samples. The matrix comparison study was performed for each measurand using paired samples on the ACE, ACE Alera and ACE Axcel analyzers.

Measurand		ACE	ACE Alera	ACE Axcel
Albumin (g/dL)	N	55	56	56
	Range	0.3-6.8	0.3-6.8	0.7-6.7
	Slope	0.991	1.002	0.956
	Intercept	0.03	-0.01	0.20
	r^2	0.987	0.991	0.985

Total Protein (g/dL)	N	56	56	81
	Range	0.5-12.3	0.5-12.0	0.5-13.9
	Slope	1.001	0.999	0.994
	Intercept	0.12	0.14	0.34
	r^2	0.979	0.984	0.989
Calcium (mg/dL)	N	56	56	81
	Range	1.0-13.7	1.0-13.7	0.7-15.0
	Slope	1.006	1.008	0.978
	Intercept	-0.01	-0.06	0.33
	r^2	0.982	0.979	0.991
Phosphorus (mg/dL)	N	100	102	56
	Range	1.3-19.3	1.3-19.3	0.9-19.8
	Slope	1.042	1.049	0.999
	Intercept	-0.26	-0.28	0.04
	r^2	0.993	0.993	0.995

3. Clinical studies:

   a. Clinical Sensitivity:

   Not applicable

   b. Clinical specificity:

   Not applicable

   c. Other clinical supportive data (when a. and b. are not applicable):

   Not applicable

4. Clinical cut-off:

   Not applicable

5. Expected values/Reference range:

   Expected values are based on the literature reference:

[1]Wu. A.H.B. (Ed), Tietz Clinical Guide to Laboratory Tests, 4th edition, Saunders Elsevier, St. Louis, MO (2006).

[2]Burtis, C.A., Ashwood, E.R. (Eds.). Tietz Fundamentals of Clinical Chemistry, 4th Edition, W.B. Saunders Co., Philadelphia, PA (1996).

[3] Heil W. Koberstein R. Zawta B. Reference ranges for Adults and Children, Pre-Analytical Considerations, 6th ed. 1999.

[1] Albumin: 5.5-5.2 g/dL

[1]Total Protein: 6.4-8.3 g/dL (Ambulatory); 6.0-7.8 g/dL (Recumbent)

[2]Calcium: 8.5-10.2 mg/dL

[1] Phosphorus: 2.7-4.5 mg/dL

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.